
UNIVERSITI SAINS MALAYSIA

Peperiksaan Kursus Semasa Cuti Panjang
Sidang Akademik 2007/2008

June 2008

Jun 2008

EMM 111/3 – Static
Statik

Duration : 3 hours

Masa : 3 jam

INSTRUCTIONS TO CANDIDATE:

ARAHAN KEPADA CALON:

Please check that this paper contains **NINE (9)** printed pages and **FIVE (5)** questions before you begin the examination.

*Sila pastikan bahawa kertas soalan ini mengandungi **SEMBILAN (9)** mukasurat bercetak dan **LIMA (5)** soalan sebelum anda memulakan peperiksaan.*

Answer **ALL** questions.

Jawab **SEMUA** soalan.

Answer all questions in **English** OR **Bahasa Malaysia** OR a combination of both.

*Calon boleh menjawab semua soalan dalam **Bahasa Malaysia** ATAU **Bahasa Inggeris** ATAU kombinasi kedua-duanya.*

Each question must begin from a new page.

Setiap soalan mestilah dimulakan pada mukasurat yang baru.

Q1. [a] A force F , applied via a frictionless pulley, act on a bracket as shown in Figure Q1[a].

- (i) Resolve and determine the 500 N force into its scalar components in the x and y direction.
- (ii) Represents F in vector notation.

Daya F dikenakan ke atas pendakap, melalui takal tanpa geseran seperti dalam Rajah S1[a].

- (i) *Leraikan dan tentukan daya 500 N kepada komponen skala dalam arah x dan y .*
- (ii) *Wakili F dalam tatatanda vektor*

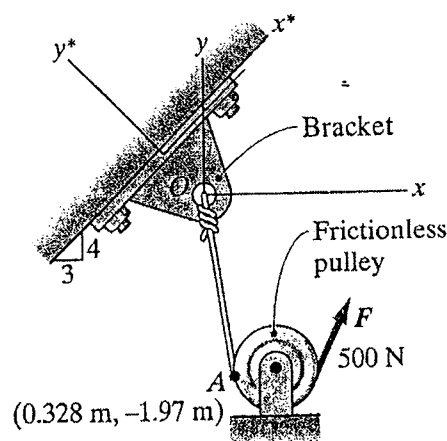


Figure Q1[a]
Rajah S1[a]

(50 marks/markah)

[b] Two forces F_1 and F_2 are applied to the hook, as shown in Figure Q1[b]. Express each force in vector notation.

Dua daya F_1 dan F_2 dikenakan pada cangkuk seperti dalam Rajah S1[b]. Nyatakan setiap daya dalam tatatanda vektor.

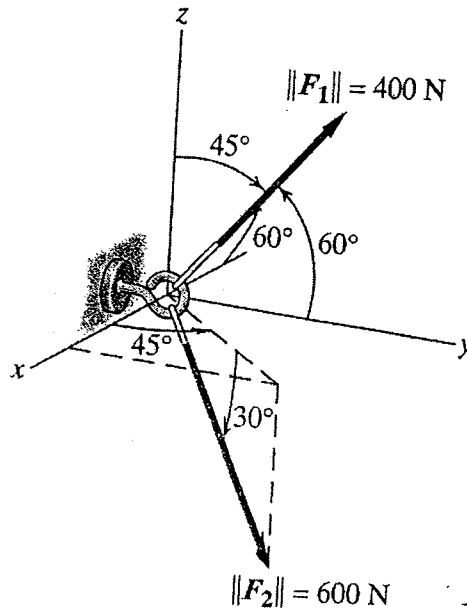


Figure Q1[b]
Rajah S1[b]

(50 marks/markah)

Q2. [a] A 610 N force acts on a lever attached to a post as shown in Figure Q2[a].

- (i) Determine the moment M_o the force creates at a moment centre at O .
- (ii) Determine the space angles associated with the moment vector.

Daya 610 N bertindak pada tuil yang di pasang pada tiang seperti Rajah S2[a].

- (i) Tentukan momen M_o yang dihasilkan oleh daya pada pusat momen di O .
- (ii) Tentukan sudut ruang bagi vektor momen berkenaan.

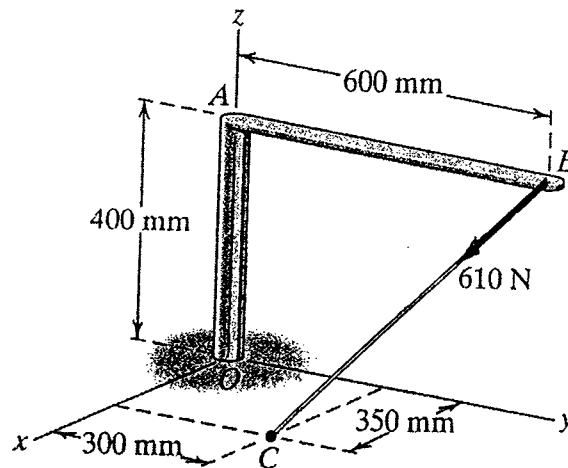


Figure Q2[a]
Rajah S2[a]

(50 marks/markah)

- [b] The street light in Figure Q2[b] is supported by cable AC. The total weight of the structure is 1600 N acting at point G, and the tension in the cable is 3600 N. The 200 N horizontal force represents the effect of the wind. Determine the equivalent force and moment acting at B.

Lampu jalan dalam Rajah S2[b] disokong oleh kabel AC. Berat keseluruhan struktur ialah 1600 N yang bertindak di titik G dan ketegangan kabel ialah 3600 N. Daya mendatar 200 N mewakili kesan angin. Tentukan daya setara dan momen setara yang bertindak di B.

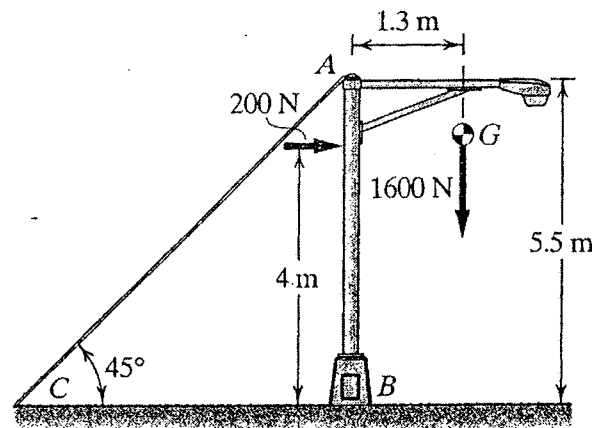


Figure Q2[b]

Rajah S2[b]

(50 marks/markah)

- Q3. [a] (i) Figure Q3[a](i) shows a frame consisting of members AB and CD supports the pulley, cable and block L. Draw a free body diagram for the whole frame, members CD and AB.

Rajah S3[a](i) menunjukkan satu kerangka terdiri dari anggota AB dan CD yang menyokong takal, kabel dan blok L. Lukis rajah badan bebas keseluruhan kerangka, anggota CD dan anggota AB.

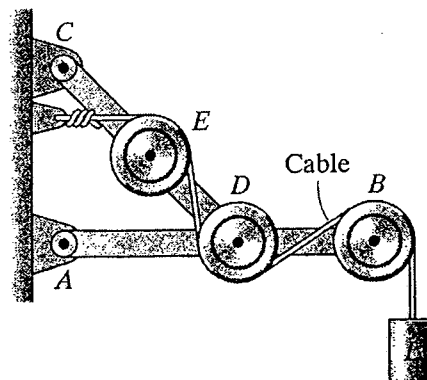


Figure Q3[a](i)

Rajah S3[a](i)

(20 marks/markah)

- (ii) A uniform beam weighing 20 kg, pinned at A and resting against a roller at B, is loaded by a 2 kN force and a 2.4 kNm moments as in Figure Q3[a](ii). Draw a free body diagram of the beam.

Sebuah rasuk seragam berjisim 20 kg di pin di A dan berada atas rola di B. Rasuk dikenakan daya 2 kN dan momen 2.4 kNm seperti dalam Rajah S3[a](ii). Lukis rajah badan bebas rasuk berkenaan.

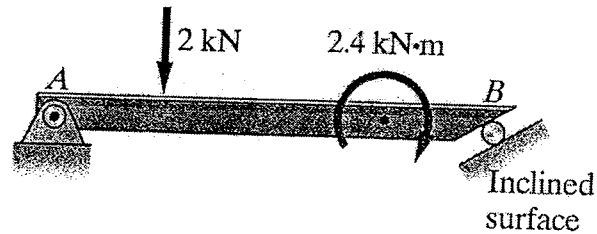


Figure Q3[a](ii)
Rajah S3[a](ii)

(10 marks/markah)

- (iii) A force acts on a brake pedal is shown in Figure Q3[a](iii). Draw a free body diagram of the frame.

Satu daya dikenakan pada injak brek seperti Rajah S3[a](iii). Lukis rajah badan bebas untuk kerangka berkenaan.

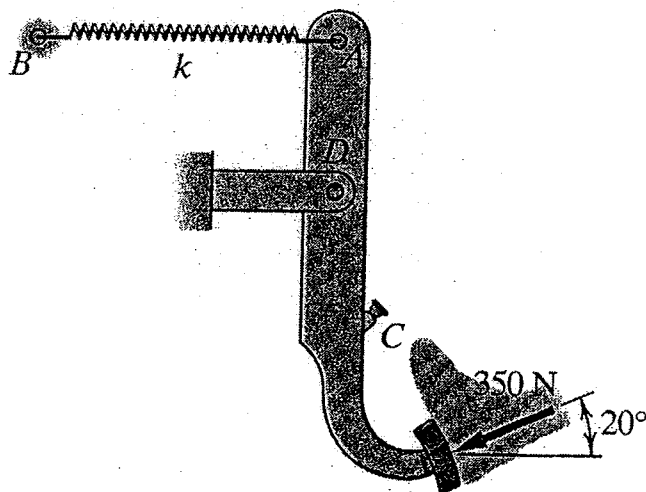


Figure Q3[a](iii)
Rajah S3[a](iii)

(10 marks/markah)

- (iv) The uniform arm AB in Figure Q3[a](iv) weighs 60 N and is pulled on by a rope at A. The system is the arm and the wheel at A. Draw the free body diagram of the system.

Sebuah lengan seragam AB dalam Rajah S3[a](iv) seberat 60 N ditarik oleh tali di A. Sistem terdiri dari lengan dan roda di A. Lukis rajah badan bebas sistem tersebut.

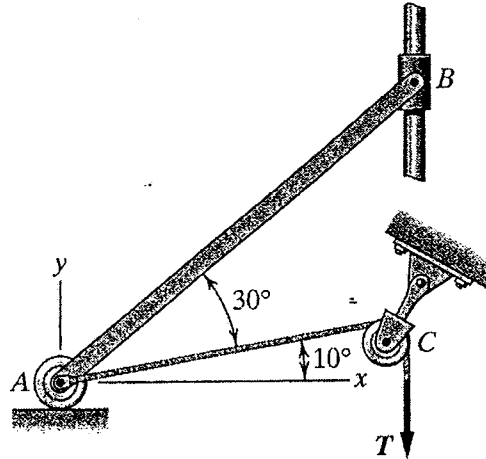


Figure Q3[a](iv)
Rajah S3[a](iv)

(10 marks/markah)

- [b] A tower crane is fixed at the ground at A as shown in Figure Q3[b]. If the crane is in equilibrium, determine the loads acting at its base due to the 4000 N cable tension. Assume that the weight of the crane is negligible.

Sebuah kren menara diikat pada lantai di A seperti Rajah S3[b]. Jika kren dalam keseimbangan, tentukan daya-daya yang dihasilkan di lantai disebabkan oleh ketegangan kabel 400 N. Abaikan berat kren.

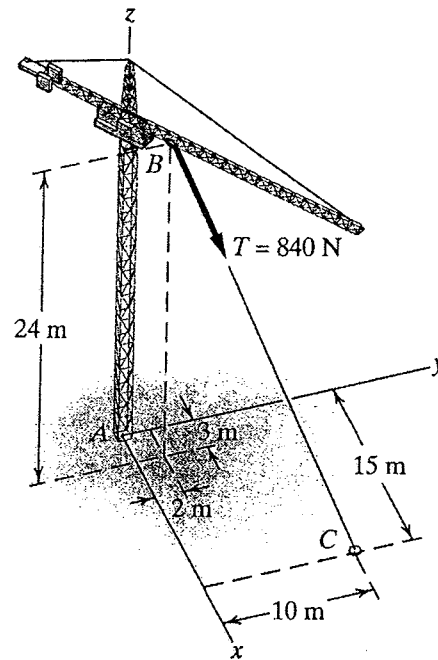


Figure Q3[b]
Rajah S3[b]

(50 marks/markah)

- Q4. [a] Figure Q4[a] shows a shaded area region. Calculate the area of the shaded region and locate its centroid.

Rajah S4[a] menunjukkan bahagian luas berlorek. Kirakan luas bahagian berlorek dan lokasi sentroid bahagian berkenaan.

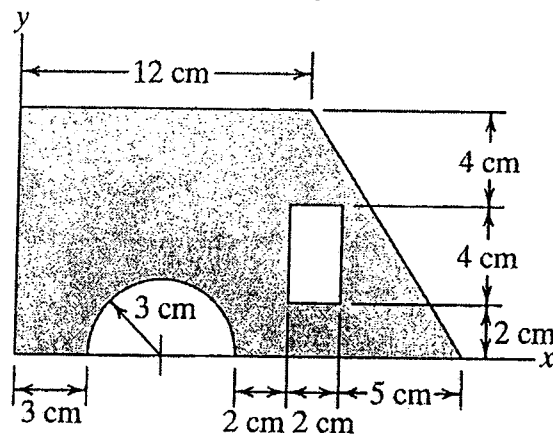


Figure Q4[a]
Rajah S4[a]

(40 marks/markah)

[b] A 3 kN force is applied to a truss, as shown in Figure Q4[b].

- (i) Find the support reaction at *A* and *D*.
- (ii) Determine the force in each member.
- (iii) State which member or members that might buckle and which ones could be replaced with cables.

Daya 3 kN dikenakan pada kekuda seperti Rajah S4[b].

- (i) Dapatkan tindakbalas penyokong di *A* dan *D*
- (ii) Tentukan daya dalam setiap anggota
- (iii) Nyatakan anggota manakah akan meleding dan manakah anggota yang boleh digantikan dengan kabel.

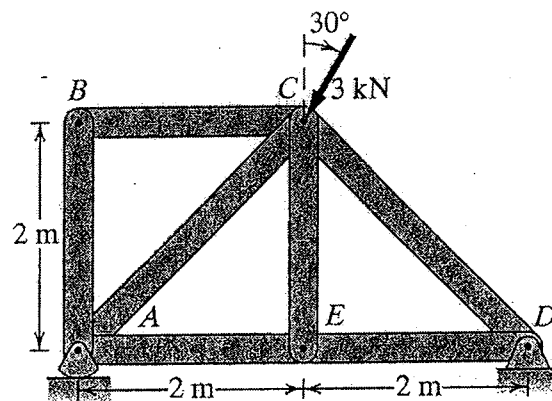


Figure Q4[b]
Rajah S4[b]

(60 marks/markah)

Q5. [a] Two solid cylindrical rods AC and CD are welded together at C and loaded axially at B, C and D as shown in Figure Q5[a].

- (i) Find the normal stress at the midpoint of rod AB and CD.
- (ii) Determine the total deformation of the rod.

(Given $E = 200 \text{ GPa}$, $A_1 = A_2 = 600 \text{ mm}^2$, $A_3 = 200 \text{ mm}^2$)

Dua rod silinder pejal AC dan CD dikimpal bersama di C dan dikenakan beban sepaksi di B, C dan D seperti Rajah S5[a]

- (i) Dapatkan tegasan normal di tengah-tengah rod AB dan rod CD.
- (ii) Tentukan anjakan keseluruhan rod berkenaan.

(Diberi $E = 200 \text{ GPa}$, $A_1 = A_2 = 600 \text{ mm}^2$, $A_3 = 200 \text{ mm}^2$)

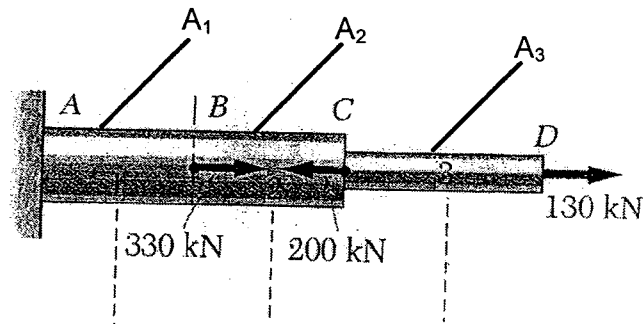


Figure Q5[a]
Rajah S5[a]

(50 marks/markah)

- [b] Link AB, of width $b = 50$ mm and thickness $t = 6$ mm, is used to support the end of a horizontal beam. The average normal stress in the link is -138 MPa and the average shearing stress in each of the two pins is 82 MPa. Determine:

- the diameter d of the pins
- the average bearing stress in the link.

Penyambung AB mempunyai lebar $b = 50$ mm dan tebal $t = 6$ mm digunakan untuk menyokong hujung sebuah rasuk mendatar. Tegasan normal purata dalam penyambung ialah -138 MPa dan tegasan ricih purata dalam setiap pin adalah 82 MPa. Tentukan

- garis pusat kedua-dua pin d
- tegasan galas purata dalam penyambung

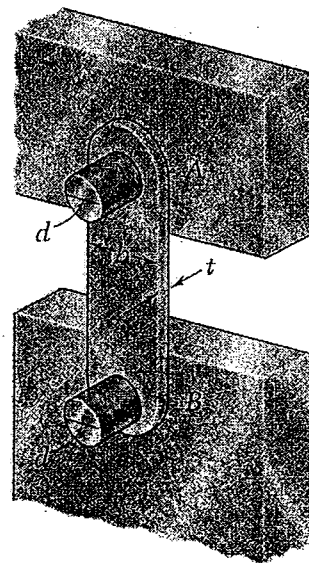


Figure Q5[b]
Rajah S5[b]

(50 marks/markah)

